Research data supporting
Regime transitions and energetics of sustained stratified shear flow

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We provide the following data:

1. The three-component velocity and density fields in space and time $(u, v, w, \rho)(x, y, z, t)$ for all 16 experiments listed in table 2, named `L1.mat, H1.mat, H2.mat, … , T3.mat`.
They are MATLAB structures containing:

- four 4D arrays `u,v,w,r` for u, v, w, ρ respectively
- four 1D arrays `x,y,z,t` for the respective coordinate grid (all flow data are given on the same grid, i.e. the density field has been interpolated to the lower-resolution grid of the velocity field).
- an `info` structure with the name given to the experiment (`internal nomenclature' used by AL and JLP starting with an `m'), the angle theta (in degrees) and the Reynolds number (table 2).

Each of these .mat files is obtained from ~150 GB of raw data, which were processed by sPIV and PLIF algorithms in the DigiFlow software package and post-processed in MATLAB (interpolation on a uniform grid, smooth interpolation to the no-slip $\mathbf{u} = 0$ and no-flux $\nabla\rho = 0$ conditions at the duct walls, divergence correction scheme of Wang et *al.* 2017 to impose $\nabla \cdot \mathbf{u} = 0$). While all computations were carried out in double precision, the structures have been converted to single precision prior to saving them on this repository in order to minimise storage costs. Feel free to convert them to double precision (MATLAB's default) after importing them.
For our notation and non-dimensionalisation of the data, see §§2.1-2.3 of the paper, and for our measurement technique and visualisation of some of these data, see §3. For the properties of the measurement volume (bounds of the `x` and `t` arrays) and resolution of the data (spacing between the points of the `x,y,z,t` arrays), see table 2 and appendix A.

2. The MATLAB codes used to compute and plot the energetics of the above data, as explained in the paper and shown in figures 10, 11, 14, 15, 16. The main code to open is `main.m`, and it calls a sub-function `computeEnergetics.m` which the user may use as a black box. Both are in the zipped folder `matlab code.zip`. Care has been taken to modify the original code used by the authors in order to make it user friendly and understandable to others (did we succeed?)

3. Movies showing all the flow fields (u, v, w, ρ) and the spanwise vorticity ω_y in a number of slices allowing for an advanced visualisation of the 4D data to complement figures 3-4. Once unzipped, each folder `L1_movies.zip, H1_movies.zip,` etc… reveals a number of movies showing all sorts of horizontal, vertical, cross-sectional slices as well as iso-surfaces/level-sets of density and vorticity (most of these iso-surface plots look admittedly rubbish). The title of each movie, although not straightforward, tells what the movie represents. Within each movie, a schematics of the duct gives more advanced information: the blue region represents the measurement volume for that particular experiment, and the red slice + the text show exactly what slice is being displayed instantaneously. All these data are unfiltered/unsmoothed. Note that the 'A' value quoted in the movie is <u>not</u> the longitudinal aspect ratio of the duct (fixed at A=30 in this paper), but the Atwood number, i.e. $At = \Delta\rho/(2\rho_0)$, from which the Reynolds number is built.

4. Plots of the mass flux $Q(t)$ and volume flux $Q_m(t)$ for each experiment, as defined in eps (3.2)-(3.3) and shown for two experiments in figures 3(k)-4(k). Once unzipped, the folder `mass and volume flux.zip` reveals one pdf per flux per experiment showing the time series of the flux, in addition to the contributions of the positive and negative velocity u^+, u^- (i.e. of each layer), and the net volume flux $\langle u \rangle_{x,y,z}$. We also show standard deviations in transparent overlay (definitions shown in the pdf). Note the Q_m file also shows the Q time series for comparison.